

Conservation of Momentum

Purpose: To measure the change of momentum of two carts as they collide with each other.

Materials: Obtain 1 Remco track, two low friction smart carts, two smart cart magnets, two 250 g masses and a ChromeBook

Step 1 – Find a workspace and set up the Remco track on a **level** surface. Attach the magnetic stopper to both of your smart carts.

Step 2 – Sync both carts to your ChromeBook via SparkVue.

Step 3- Place one smart cart to the left. Place the second cart in the middle of the ramp. Practice sliding the first cart into the second cart. To keep the carts impacting correctly, have the moving cart slide along the rail of the track. Success is reached when the first cart strikes the second cart at a reasonable speed and does not stray from the rail of the track. Once you are comfortable with the sliding, start a run by turning on the SparkVue program and slide the first cart into the second cart. Stop the program and slide Run 1 into the graphing feature. Find the velocity immediately before the collision and immediately after the collision of the two carts. Enter the velocities and momentum of cart one and cart two into the chart provided.

Step 4 - Place 2-250 g masses on the second cart and set up the carts as in Step 3. Repeat step 3. Find the new velocities and record the new velocities and momentum for cart one and two. Record your data in the chart.

Step 5 – In the third trial, place 2-250 g masses on the first cart and repeat step 3. Find the new velocities and record the new velocities and momentum for cart one and two. Record your data in the chart.

Step 6 – In the fourth trial, place the carts facing each other. Have the carts collide with each other. Find the new velocities and record the new velocities and momentum for cart one and two. Record your data in the chart.

Step 7 – In the fifth trial, place 2-250g masses onto the second cart and then have them face each other. Advance the carts toward each other and collide. Find the new velocities and record the new velocities and momentum for cart one and two. Record your data in the chart.

Step 8 - In the sixth trial, place 2-250g masses onto the first cart and then have them face each other. Advance the carts toward each other and collide. Find the new velocities and record the new velocities and momentum for cart one and two. Record your data in the chart.

Step 9 – In the seventh trial, place each cart back-to-back and touching each other with the plunger facing toward the other cart. Tap the plunger button to release the plunger. Find the new velocities and record the new velocities and momentum for cart one and two. Record your data in the chart.

Step 10 – In the eighth trial, place 2-250 g masses on the first cart. Then, place each cart back-to-back and touching each other with the plunger facing toward the other cart. Tap the plunger button to release the plunger. Find the new velocities and record the new velocities and momentum for cart one and two. Record your data in the chart.

Step 11 – In the final trial, place one smart cart to the left. Place the second cart in the middle of the ramp. Have the Velcro side of the each smart cart facing each other. Push the first cart toward the second cart. Once they have collided, the carts should stick together and slide together. Find the new velocities and record the new velocities and momentum for cart one and two. Record your data in the chart.

Conservation of Momentum

Wafi Hassan

| Trial | cart mass 1 | cart mass 2 | initial v 1 | initial v 2 | final v 1 | final v 2 |
|---------|------------------|-------------------------|------------------------|----------------|-----------|----------------------|
| Trial 1 | • 270 kg | • 270 kg | 0.5 | 0 | 0 | -0.44 |
| Trial 2 | • 270 kg | • 270 770 kg | 0.483 | 0 | • -0.23 | -0.23 |
| Trial 3 | • 770 kg | • 270 kg | 0.5 | 0 | 0.2 | -0.615 |
| Trial 4 | • 270 kg | 0.270 kg | 0.412 | 0.40263 | -0.343 | -0.427 |
| Trial 5 | • 270 kg | 0.770 kg | 0.287 | 0.258 | -0.381 | -0.04 |
| Trial 6 | • 770 kg | • 270 kg | • 358 | • 520 | -0.07 | -0.667 |
| Trial 7 | • 270 kg | • 270 kg | 0 | 0 | 0.71 | -0.82 |
| Trial 8 | • 770 kg | 0.270 kg | 0 | 0 | 0.3 | -1 |
| Trial 9 | • 270 kg | • 270 kg | -0.48 | 0 | -0.25 | 0.24 |
| | Initial Momentum | | Total Initial Momentum | Final Momentum | | Total Final Momentum |
| | Cart 1 | Cart 2 | Cart 1 and Cart 2 | Cart 1 | Cart 2 | Cart 1 and Cart 2 |
| Trial 1 | | | | | | |
| Trial 2 | | | | | | |
| Trial 3 | | | | | | |
| Trial 4 | | | | | | |
| Trial 5 | | | | | | |
| Trial 6 | | | | | | |
| Trial 7 | | | | | | |
| Trial 8 | | | | | | |
| Trial 9 | | | | | | |

- 1) Write a formula for the momentum **before** the collision. Consider the mass and velocity of each object.
- 2) Write a formula for the momentum **after** the collision. Consider the mass and velocity of each object.

Conservation of Momentum

- 3) In trial 1, how does the momentum before collision compare with the momentum after the collision?
- 4) In trial 2, how does the momentum before collision compare with the momentum after the collision?
- 5) In trial 7, how does the momentum before collision compare with the momentum after the collision?
- 6) In trial 9, how does the momentum before collision compare with the momentum after the collision?